HEAVY VEHICLE EMISSIONS REDUCTION

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Federal and state emission standards for heavy duty diesel engines has resulted in the evaluation of various engine modification (in-cylinder and EGR) and aftertreatment strategies to reduce NOx and particulates from stationary and mobile diesel engines. Past emissions requirements have been achieved by controlling engine combustion parameters. Mandates on extremely low NOx and particulate levels may require an external aftertreatment device downstream of the engine.

This paper will focus on the various aftertreatment technologies being developed by Noxtech, Inc. for the heavy vehicle market. Specifically, a Noxtech chemical aftertreament system and a non-thermal plasma assisted catalyst system will be reviewed and compared to other approaches to engine-out emissions control.

Noxtech, Inc. has developed a chemical injection system for the selective non-catalytic reduction of NOx and particulates from diesel engines. This non-catalytic approach uses an innocuous chemical at 1300-1500°F to achieve greater than 95% NOx reduction, with concurrent particulate and hydrocarbon removal. The reaction temperature is achieved by combustion of supplemental diesel fuel. Advanced designs offered by Noxtech incorporate a compact and efficient muffler sized reactor, simplified controls and chemical and supplemental fuel delivery systems. The salient features and performance characteristics of this advanced Noxtech system will be discussed.

Noxtech is also developing a non-thermal plasma assisted catalyst system for simultaneous NOx and particulate removal. This system selectively reduces NOx to N_2 and oxidizes particulates and hydrocarbons to CO_2 and H_2O without the use of additives under lean conditions with low energy consumption. This is achieved by generating a non-thermal plasma across a catalytic packed bed; the plasma providing a highly energetic and selective surface for NOx and particulate removal. Performance tests in engine exhausts containing in excess of 15% O_2 have demonstrated in excess of 70% removal of NOx and 80% removal of particulates, using less than 7% of engine bhp.

These aftertreatment approaches are geared towards reducing NOx and particulate emissions from lean exhausts. Present-day diesel engines are optimized for emissions and performance instead of performance and economy. The use of a cost effective emissions reduction device will help boost combustion efficiency and may offer the potential for substantial reduction in engine cost.